

**REMARKS**

Claims 1-27 are pending in the present application, of which claims 1, 11, and 21 are in independent form. In the present Amendment, claims 1, 7, 11, 13-17, and 21 have been amended.

Claims 1-3, 5, 11-13, and 15 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,732,170 (Okude). Claims 4, 6, 14, and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and U.S. Patent No. 6,336,749 (O'Toole). Claims 7-10, 17-23, and 25-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and U.S. Patent No. 5,372,623 (Ueda). Entry of this Amendment and reconsideration of the rejections is respectfully requested.

Attached to the Office Action is a copy of the PTO-1449 form from the Information Disclosure Statement (IDS) submitted on February 16, 2004, in which the journal articles "Simple Fusion Splicing Technique For Reducing Splicing Loss Between Standard Singlemode Fibres And Erbium-Doped Fibre," Electronic Letters, August 15, 1991 Vol 27, No. 17; "Erbium-Doped Fiber Splicing and Splice Loss Estimation," IEEE Journal of Lightwave Technology, Vol 12, No. 3, March 3, 1994, "Thermally-Diffused Expanded Core Fibres For Low-Loss And Inexpensive Photonic Components," Electronic Letters, October 10, 1991, Vol. 27, No. 21; and "Low-Loss Optical Connector Between Dissimilar Single-Mode Fibers using Local Core Expansion Technique by Thermal Diffusion," IEEE

Photonics Technology Letters, Vol. 4, No. 9, September 1992, were crossed out with an indication that no copies were provided. Although Applicants believe that copies of those journal articles were submitted with the IDS, enclosed herewith are courtesy copies for the Examiner's convenience, as well as a copy of the corresponding pages of the PTO-1449 form. The Examiner is respectfully requested to return an initialed copy of those pages of the PTO-1449 form upon consideration of the journal articles.

Additionally, an IDS and a corresponding PTO-1449 form were submitted on February 14, 2005, prior to the mailing date of the February 25, 2005 Office Action, as evidenced by the returned receipt postcard bearing the stamp of the U.S. Patent and Trademark Office, a copy of which is attached. Applicants respectfully request the Examiner to return an initialed copy of the PTO-1449 form, indicating that the references listed thereon have been considered and made of record in the present application.

**Rejections Under 35 U.S.C. § 102(b)**

Claims 1-3, 5, 11-13 and 15 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Okude.

As best understood by Applicants, in general, Okude describes a method including heating, via an oxyhydrogen flame, an internal section of a fiber to form an expanded core portion, and then, cutting the fiber in that expanded portion to form a free end. That free end is subsequently fusion-spliced to a free end of another fiber. An arc discharge from a

pair of electrodes is then used to heat an internal portion of the newly formed fiber at the fusion splice connection point of the two previously free ends.

Specifically, Okude describes that, "[a]s shown in FIG. 2A, one [internal] portion of bare single mode optical fiber 22 is heated for 10 to 100 seconds at 1800 degree to 2000 degree C with an oxyhydrogen flame, diffusing the germanium in the silica glass which forms core 18, thereby forming an expanded portion 34 in core 18." (See Okude at col. 18, lns. 19-23.) Okude further describes that the "center of this expanded portion 34 is cut, and fusion spliced to the ends of a standard GI optical fiber as a bare multimode optical fiber 15, as shown in FIG. 2B." (Id. at col. 18, lns. 24-26.)

Okude then describes that:

as shown in FIG. 3A, the end of bare single mode optical fiber 22 and the end of bare multimode optical fiber 15 are fusion spliced, and this fusion spliced points 24 is placed between a pair of discharge electrodes. Using an arc discharge from the pair of discharge electrodes, the [internal] vicinity of fusion spliced points 24 is heated for 5 to 60 seconds, at 1900 degree to 2100 degree C, to form expanded core portion 34.

The other end of this bare multimode optical fiber 15 is fusion spliced to the end of another bare single mode optical fiber 22 in the same manner, and an expanded portion 34 in the core is formed.

(Id. at col. 18, lns. 34-47.) Thus, Okude describes heating internal sections of fibers with either an oxyhydrogen (gaseous fuel) flame or an electrical discharge from electrodes.

Okude is note understood to describe heating a free end of a fiber.

Claim 1, as amended, recites, *inter alia*, a method for expanding a mode-field diameter of an optical fiber that includes the step of "heating a free end of the optical fiber to a temperature within a range of about 500 °C to about 2000°C."

As described in the specification of the present application, the claimed invention includes a method for "expanding the mode-field diameter of an optical fiber by heating the end of the optical fiber." (See first three lines of ¶ [0009] of the specification as published.) As would be clear to one of ordinary skill in the art, when reading the specification of the present application, the phrase "heating the end" of a fiber has the meaning of heating a free end of a fiber, and not merely an internal section of a fiber, or merely an internal section of a fiber that includes a fusion splice point at which two previously free ends of two fibers are joined. "The methods of the invention improve over prior-art methods that comprise first heating an internal section of an optical fiber and then cleaving the fiber at the heat-treated portion." (Id. at last four lines of ¶ [0009].)

In addition, by way of the claimed invention, "because the end of the optical fiber to be spliced is heated, rather than an internal section, issues related to exact alignment of the fiber; maintaining a precise tension of the fiber; and issues of mode-field distortions are precluded." (Id. at ¶ [0014].) Thus, the claimed feature of heating a free end of a fiber has certain benefits over methods that include merely heating an internal portion of a fiber.

With respect to Okude, Applicants respectfully submit that Okude does not describe all of the features of amended claim 1. For example, amended claim 1 recites "heating a free end of the optical fiber to a temperature within a range of about 500 °C to about

2000°C." As described above, Okude does not appear to Applicants to teach or suggest heating a free end of a fiber, but merely describes heating an internal section of a fiber, or merely an internal section of a fiber that includes a fusion splice point at which two previously free ends of two fibers are joined.

Accordingly, Applicants submit that Okude does not teach, suggest, or provide motivation for the present invention, as set forth in claim 1. Therefore, Applicants submit that amended claim 1 is patentable over Okude, and withdrawal of the rejection to claim 1 under 35 U.S.C. § 102(b) is respectfully requested.

Claims 2, 3, and 5 each depend from claim 1. Accordingly, Applicants submit that claims 2, 3, and 5 are patentable over Okude, for at least the reasons discussed above with respect to the rejection of claim 1. Therefore, withdrawal of the rejections to claims 2, 3, and 5 under 35 U.S.C. § 102(b) is respectfully requested.

Independent claim 11, as amended, recites features similar to those discussed above with respect to the rejection of claim 1. For example, amended claim 11 recites, *inter alia*, a method of splicing a first optical fiber having a smaller mode-field diameter to a second optical fiber having a larger mode-field diameter, wherein a "free end" of the first optical fiber is heated to a temperature within a range of about 500 °C to about 2000 °C to expand its mode field. The free end of the first optical fiber with the expanded mode field is abutted with a free end of the second optical fiber having the larger mode-field diameter.

Accordingly, Applicants submit that claim 11 is patentable over Okude, for at least the reasons stated above with respect to the rejection of claim 1. For example, as described

above, Okude does not teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof. Therefore, withdrawal of the rejection to claim 11 under 35 U.S.C. § 102(b) is respectfully requested.

Claims 12, 13, and 15 each depend from claim 11. Accordingly, Applicants submit that claims 12, 13, and 15 each are patentable over Okude, for at least the reasons stated above with respect to the rejection of claim 11. Therefore, withdrawal of the rejections to claims 12, 13, and 15 under 35 U.S.C. § 102(b) is respectfully requested.

**Rejections Under 35 U.S.C. § 103(a)**

Claims 4, 6, 14, and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and O'Toole.

Claims 4 and 6 each depend from amended claim 1, and claims 14 and 16 depend from amended claim 11. Accordingly, Applicants submit that claims 4, 6, 14, and 16 each are patentable over Okude, for at least the reasons discussed above with respect to the rejection of claim 11. For example, as discussed above, Okude does not teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof.

O'Toole does not cure these deficiencies of Okude. As understood by Applicants, O'Toole describes a method of heating, by way of an oxy-hydrogen flame, "fibers in the region of [a] fusion splice to produce diffusion of dopants therein to form a longitudinal diffused region." (See O'Toole at col. 3, lns. 42-45.) O'Toole also describes heating and "thereby softening the fibers in the region of [a] fusion splice, and axially forcing the

spliced fibers towards one another to produce a fattening thereof in the region of the [previously made] fusion splice." (Id. at col. 4, lns. 33-37.) Thus, O'Toole does not appear to Applicants to teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof.

Accordingly, Applicants submit that neither Okude nor O'Toole, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed invention. Therefore, Applicants submit that each of claims 4, 6, 14, and 16 is patentable over the hypothetical combination of Okude and O'Toole. Withdrawal of the rejections to claims 4, 6, 14, and 16 under 35 U.S.C. § 103(a) is respectfully requested.

Claims 7-10, 17-23, and 25-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and Ueda.

Claims 7-10 each ultimately depend from amended claim 1, and claims 17-20 each ultimately depend from amended claim 11. Accordingly, Applicants submit that each of claims 7-10, and 17-20 are patentable over Okude, for at least the reasons discussed above with respect to the rejections of claims 1 and 11. For example, as discussed above, Okude does not appear to Applicants to teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof.

Ueda does not cure these deficiencies of Okude. As understood by Applicants, Ueda describes a method of forming a glass container by a press-blow system. Ueda appears to describe that the burning of a boron or silicon gas can be used prior to blow

molding a jar or container. Thus, Ueda does not appear to Applicants to teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof.

Accordingly, Applicants submit that neither Okude nor Ueda, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed invention. Therefore, Applicants submit that each of claims 7-10, and 17-20 are patentable over the hypothetical combination of Okude and Ueda. Withdrawal of the rejections to claims 7-10, and 17-20 under 35 U.S.C. § 103(a) is respectfully requested.

Moreover, Applicants submit that dependent claims 7 (and claims 8-10 depending therefrom) and 17 (and claims 18-20 depending therefrom) are each patentable for additional reasons. For example, claim 7 recites, *inter alia*, heating the free end of the optical fiber by "applying heat generated by a fuel source, wherein the fuel source comprises an organic liquid," while claim 17 recites heating the free end of the optical fiber by "applying heat generated by a fuel source, wherein the fuel source comprises an organic liquid."

As conceded in the Office Action, Okude describes the use of an oxyhydrogen fuel, but does not teach or suggest the use of an organic liquid fuel source. In the Office Action, the Examiner contends that Ueda provides this feature. While, as understood by Applicants, Ueda describes that methanol may be used during a glass-blowing process, Ueda does not appear to teach or suggest that methanol should be used as part of a fiber optic splicing process.



Further, with regard to the proposed hypothetical Okude-Ueda combination of references cited in the Office Action, Applicants note that no motivation to combine these references is presented in the Office Action.

As described in the specification, Applicants have discovered the new and advantageous use of an organic liquid-fueled flame for use in expanding the mode-field diameter of an optical fiber:

An organic-liquid-fueled flame provides a near ideal temperature profile for diffusing the dopants in a dispersion compensating fiber. It causes the dopants to diffuse gradually along the length of fiber in the flame, resulting in a relatively long, gradual expansion of the mode-field diameter over a length of about 1 mm to about 6 mm, more preferably, of about 2 mm to about 4 mm. The gradual mode-field diameter expansion minimizes the splice loss after the heat-treated fiber is spliced. The organic liquid does not require additives and burns clean. The preferred organic liquids, (alcohols with six or fewer carbon atoms and only one hydroxyl group, more preferably, methanol) generate primarily water vapor and CO.sub.2. Hence, the flame does not leave an organic residue on the fiber.

(See ¶ [0019] of the specification as published.)

Applicants respectfully submit that the glass-blowing methods described by Ueda, either taken alone, or in combination with Okude, do not teach or suggest the claimed use of an organic liquid fuel source to expand the mode field of a fiber.

Therefore, Applicants submit that each of claims 7-10, and 17-20 are patentable over the hypothetical combination of Okude and Ueda for these additional reasons.

Withdrawal of the rejections to claims 7-10, and 17-20 under 35 U.S.C. § 103(a) is respectfully requested.

Amended independent claim 21 recites features similar to those discussed above with respect to independent claims 1 and 11. For example, amended claim 21 recites, *inter alia*, a method for expanding a mode-field diameter of an optical fiber, wherein a "free end" of the optical fiber is heated to a temperature within a range of about 500 °C to about 2000°C by applying heat to the optical fiber generated by a fuel source. The fuel source comprises an organic liquid.

Accordingly, Applicants submit that claim 21 is patentable over Okude, for at least the reasons stated above with respect to the rejections of claims 1 and 11. Ueda does not cure these deficiencies of Okude. As described above, as understood by Applicants, Ueda describes a method of forming a glass container by a press-blow system, and to Applicants' knowledge, does not teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof.

Accordingly, Applicants submit that neither Okude nor Ueda, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed invention. Therefore, Applicants submit that claim 21 is patentable over the hypothetical combination of Okude and Ueda. Withdrawal of the rejection to claim 21 under 35 U.S.C. § 103(a) is respectfully requested.

Each of claims 22, 23, and 25-27 depend from amended claim 21. Accordingly, Applicants submit that each of claims 22, 23, and 25-27 is patentable over the Examiner's proposed Okude-Ueda combination, for at least the reasons discussed above with respect to the rejections of claims 21.

Accordingly, Applicants submit that neither Okude nor Ueda, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed invention. Therefore, Applicants submit that each of claims 22, 23, and 25-27 is patentable over the hypothetical combination of Okude and Ueda. Withdrawal of the rejections to claims 22, 23, and 25-27 under 35 U.S.C. § 103(a) is respectfully requested.

Moreover, Applicants submit that independent claim 21, and claims 22, 23, and 25-27 depending therefrom, are each patentable for additional reasons. As discussed above with respect to claims 7-10, and 17-20, claim 21 recites, *inter alia*, "applying heat to the optical fiber generated by a fuel source, wherein the fuel source comprises an organic liquid."

As discussed above, Applicants believe that neither Okude nor Ueda, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed application of heat to an optical fiber generated by a fuel source that includes an organic liquid. Therefore, Applicants submit that claim 21, and claims 22, 23, and 25-27 depending therefrom, are patentable over the hypothetical combination of Okude and Ueda.

Withdrawal of the rejections to claims 21-23, and 25-27 under 35 U.S.C. § 103(a) is respectfully requested.

**Summary**

In view of the foregoing, it is respectfully submitted that the claims, as amended, define a novel and patentable invention. Accordingly, this application fully meets the requirements of 35 U.S.C. §§ 102 and 103 and is now in condition for allowance. Entry of this Amendment and reconsideration and favorable action in this regard is therefore earnestly solicited.

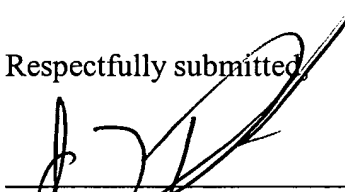
Appln. No. 10/717,856  
Amendment dated April 25, 2005  
Reply to Office Action of February 25, 2005

**CONCLUSION**

Applicant's undersigned attorney may be reached by telephone at (973) 597-2500.

All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

  
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